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JIS C 3810 : 1999

**Normal type and anti-pollution type
suspension insulators**

ICS 29.080.10

Descriptors : electric insulators, electrical porcelain, porcelain, suspension insulators,
high voltage, electric power transmission lines, overhead power lines,
glass, chemical-resistant materials, chlorides

Reference number : JIS C 3810 : 1999 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS C 3810 : 1992** is replaced with **JIS C 3810 : 1999**.

In this revision, the former **JIS** has been reviewed and specified as the body, and International Standards corresponding to various parts of above **JIS** have been specified as Annexes (normative) for conformity with International Standards.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Normal type and anti-pollution type suspension insulators

Introduction This Japanese Industrial Standard has been prepared based on **IEC 60305** *Insulators for overhead lines with a nominal voltage above 1 000 V—Ceramic or glass insulator units for a.c. systems—Characteristics of insulator units of the cap and pin type* published in 1995 as the fourth edition, **IEC 60120** *Dimensions of ball and socket couplings of string insulator units* published in 1984 as the third edition, and **IEC 60471** *Dimensions of clevis and tongue couplings of string insulator units* published in 1977 as the second edition, in such a manner that the contents (classification, performances, shapes and dimensions) of the former **JIS** are specified in the body, and the corresponding International Standards are stated in Annex 1, Annex 2 and Annex 3 without modification in their technical contents.

The **IEC** Standard number is based on the new numbering system of **IEC** Standards put in force on January 1st 1997, and the Standard published before the said date is numbered by adding 60000 to the former number. This is only the change in the numbering system and the contents remain unchanged.

1 Scope This Standard specifies normal type and anti-pollution type porcelain and glass suspension insulators mainly used for a.c. overhead lines (hereafter referred to as “insulators”) and this is applicable to the following insulators.

- a) The porcelain insulators specified in the former **JIS**. They are specified in the body of this Standard.
- b) The ceramic or glass insulators for a.c. overhead lines with a nominal voltage above 1 000 V and a frequency lower than 100 Hz specified in **IEC 60305**. They are specified in the annexes (normative) to this Standard.

Either of the specifications stated in this body or those stated in Annexes (normative) shall be applied throughout to a product, and it is not allowed to apply the corresponding items and contents from the body and annexes confusedly.

Remarks : The International Standards corresponding to this Standard are given below.

IEC 60120 : 1984 *Dimensions of ball and socket couplings of string insulator units*

IEC 60305 : 1995 *Insulators for overhead lines with a nominal voltage above 1 000 V—Ceramic or glass insulator units for a.c. systems—Characteristics of insulator units of the cap and pin type*

IEC 60471 : 1977 *Dimensions of clevis and tongue couplings of string insulator units*

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS C 3801-1 *Testing method for insulators—Part 1 : Insulators for overhead line*

JIS C 3802 *Permissible limits of visual defects for insulating porcelains*

JIS C 3803 *Glossary of terms for insulator and bushing*

JIS G 3101 *Rolled steels for general structure*

JIS G 4309 *Stainless steel wires*

JIS G 5502 *Spheroidal graphite iron castings*

JIS G 5702 *Blackheart malleable iron castings*

JIS H 3260 *Copper and copper alloy wires*

JIS R 5210 *Portland cement*

3 Definitions For the purposes of this Standard, the definitions given in **JIS C 3803** apply.

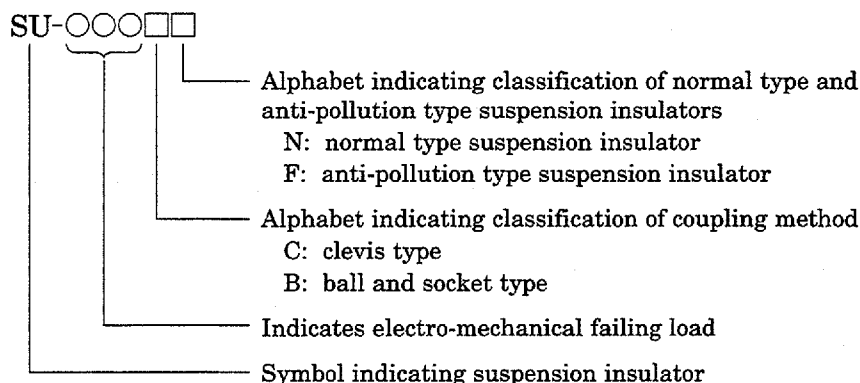
4 Classification and symbols The insulators are classified and symbolized as shown in Table 1, according to the diameter of porcelain part, shape of coupling part, distinction of normal type suspension insulator and anti-pollution type suspension insulator as well as electro-mechanical failing load.

Table 1 Classification and symbols

Name	Electro-mechanical failing load kN	Symbol
250 mm clevis type suspension insulator	120	SU-120CN
250 mm ball and socket type suspension insulator	165	SU-165BN
250 mm ball and socket anti-pollution type suspension insulator	120	SU-120BF
250 mm ball and socket anti-pollution type suspension insulator	165	SU-165BF
280 mm ball and socket type suspension insulator	210	SU-210BN
320 mm ball and socket anti-pollution type suspension insulator	210	SU-210BF
320 mm ball and socket type suspension insulator	330	SU-330BN
400 mm ball and socket anti-pollution type suspension insulator	330	SU-330BF
340 mm ball and socket type suspension insulator	420	SU-420BN
380 mm ball and socket type suspension insulator	530	SU-530BN

Remarks 1 If there is no possibility of confusion in the above-mentioned names, the phrase "ball and socket type" may be omitted.

2 Meaning of symbols is as follows:



5 Performances The performances of insulator shall comply with Table 2, when the insulator is tested in accordance with the method specified in 9.

Table 2 Performances

Item	Performances	Applicable subclause for test method
Wet power-frequency withstand voltage	Not to cause breaking discharge with the voltage given in Attached Figs. 1 to 10.	9.3
Impulse withstand voltage	Not to cause breaking discharge with the voltage given in Attached Figs. 1 to 10.	9.4
Power-frequency puncture voltage in oil	Not to pass through with the voltage given in Attached Figs. 1 to 10.	9.5
Electro-mechanical failing load	Not to break down with the load given in Attached Figs. 1 to 10.	9.6
Creepage distance	To have the value given in Attached Figs. 1 to 10.	9.7
Temperature cycle	When alternately dipped into water at least 90 °C different, where cold water temperature is 0 °C to 10 °C 3 times, for 15 min each, no abnormality shall be recognized on any parts of insulator.	9.8
Porosity	The liquid shall not penetrate into porcelain.	9.9
Galvanizing	Mass of deposition: 500 g/m ² or more.	9.10
Power-frequency voltage	No abnormality shall be recognized on any parts of insulator, when the voltage given in Attached Figs. 1 to 10 is applied.	9.11
High frequency voltage	No abnormality shall be recognized on any parts of insulator.	9.12
Tensile withstand load	No abnormality shall be recognized on any parts of insulator, when the load given in Attached Figs. 1 to 10 is applied.	9.13

6 Shape and dimensions

- a) Shape and dimensions shall be as shown in Attached Figs. 1 to 12.
- b) In ball and socket type suspension insulator, the socket part of cap and the ball part of ball pin shall fit the relevant gauges given in Attached Fig. 13.

7 Appearance On the appearance of insulator, there shall be no defect detrimental to practical service.

The appearance of porcelain part shall comply with the requirements specified in JIS C 3802.

8 Materials and assembly

8.1 Materials The materials shall be as given in Table 3, and hot galvanizing shall be completely and uniformly applied on whole surface of cap, pin and cotter.

Table 3 Materials

Name of parts		Materials
Porcelain		Porcelain whole exposed part of which is glazed uniformly; unless otherwise specified, the colour shall be light grey.
Cap		FCMB310 specified in JIS G 5702 or FCD400 or FCD450 specified in JIS G 5502. However, FCD500 specified in JIS G 5502 is added for ball and socket type suspension insulators of 340 mm and 380 mm.
Pin	250 mm clevis type suspension insulator	SS400 specified in JIS G 3101
	250 mm ball and socket anti-pollution type suspension insulator 120 kN	SS490 specified in JIS G 3101 or high strength steel having tensile strength of 705.6 N/mm ² or more, elongation of 17 % or more
	250 mm ball and socket type suspension insulator	High strength steel having tensile strength of 705.6 N/mm ² or more, elongation of 17 % or more
	250 mm ball and socket anti-pollution type suspension insulator 165 kN	
	280 mm ball and socket type suspension insulator	
	320 mm ball and socket anti-pollution type suspension insulator	
	340 mm ball and socket type suspension insulator	
	380 mm ball and socket type suspension insulator	
	320 mm ball and socket type suspension insulator	High strength steel having tensile strength of 725.2 N/mm ² or more, elongation of 17 % or more
	400 mm ball and socket anti-pollution type suspension insulator	

Table 3 (concluded)

Name of parts		Materials
Cotter	250 mm clevis type suspension insulator	SS490 specified in JIS G 3101
Split pin	250 mm clevis type suspension insulator	C2600W or C2700W specified in JIS H 3260
	250 mm ball and socket type suspension insulator	SUS304 specified in JIS G 4309
	250 mm ball and socket anti-pollution type suspension insulator	
	280 mm ball and socket type suspension insulator	
	320 mm ball and socket anti-pollution type suspension insulator	
	320 mm ball and socket type suspension insulator	
	400 mm ball and socket anti-pollution type suspension insulator	
	340 mm ball and socket type suspension insulator	
	380 mm ball and socket type suspension insulator	
Cement		Portland cement specified in JIS R 5210

8.2 Assembly The insulator shall be assembled as follows:

- a) Clevis type suspension insulator shall be so assembled that the centre lines of porcelain and metal fittings are aligned, and the holes of clevis and pin will become in the same direction.
- b) Ball and socket type suspension insulator shall be so assembled that the centre lines of porcelain and metal fittings are aligned, and the position of marking of insulator and the position of hole for split pin becomes on the same side, with their centres lying almost on a straight line.

9 Test method**9.1 Construction test** The construction test shall follow clause 5 of **JIS C 3801-1**.**9.2 Appearance test** The appearance test shall follow clause 6 of **JIS C 3801-1**.**9.3 Wet power-frequency withstand voltage test** The wet power-frequency withstand voltage test shall follow 7.4 of **JIS C 3801-1**.**9.4 Lightning impulse withstand voltage test** The lightning impulse withstand voltage test shall follow 7.9 of **JIS C 3801-1**.**9.5 Power-frequency puncture voltage test in oil** The power-frequency puncture voltage test in oil shall follow 7.5 of **JIS C 3801-1**.

9.6 Electro-mechanical failing load test The electro-mechanical failing load test shall follow clause 9 of JIS C 3801-1.

9.7 Creepage distance test In the creepage distance test, the minimum distance along the outer surface of insulating material between the electrodes of insulator shall be measured.

9.8 Temperature cycle test The temperature cycle test shall follow clause 10 of JIS C 3801-1.

9.9 Porosity test The porosity test shall follow clause 11 of JIS C 3801-1.

9.10 Galvanizing test The galvanizing test shall follow clause 12 of JIS C 3801-1.

9.11 Power-frequency voltage test The power-frequency voltage test shall follow 7.6 of JIS C 3801-1.

9.12 High frequency voltage test The high frequency voltage test shall follow 7.7 of JIS C 3801-1.

9.13 Tensile withstand load test The tensile withstand load test shall follow 8.1.1 of JIS C 3801-1.

10 Inspection The inspection consists of type inspection and acceptance inspection, and is carried out in accordance with clause 9 Test method.

10.1 Type inspection The type inspection shall be made on all items specified in Table 4, and the requirements specified in clauses 5 to 8 shall be satisfied.

The number of test pieces for this inspection shall be determined by the agreement between the parties concerned.

10.2 Acceptance inspection The acceptance inspection consists of two kinds, namely sampling inspection and 100 % inspection.

10.2.1 Sampling inspection The sampling inspection shall be made on the items of c) to i) specified in Table 4, and the requirements specified in clauses 5, 6 and 8 shall be satisfied.

The sampling inspection plan and acceptability criteria shall be determined by the agreement between the parties concerned.

10.2.2 100 % inspection The 100 % inspection shall be made on the items of j) to m) specified in Table 4, and the requirements specified in clauses 5 and 7 shall be satisfied.

The insulators which do not pass this inspection shall be rejected, and the lot after excluding these defective insulators is accepted.

Table 4 Inspection items

Inspection items
a) Wet power-frequency withstand voltage
b) Lightning impulse withstand voltage
c) Construction
d) Creepage distance
e) Power-frequency puncture voltage in oil
f) Electro-mechanical failing load
g) Temperature cycle
h) Porosity
i) Galvanizing
j) Appearance
k) Power-frequency voltage
l) High frequency voltage
m) Tensile withstand load

11 Designation of product The product shall be designated by the name or symbol. For 250 mm ball and socket anti-pollution type suspension insulator, however, designation shall be by the name and electro-mechanical failing load or the symbol.

Examples : 250 mm clevis type suspension insulator or SU-120CN

250 mm ball and socket type suspension insulator or SU-165BN

250 mm ball and socket anti-pollution type suspension insulator 120 kN
or SU-120BF

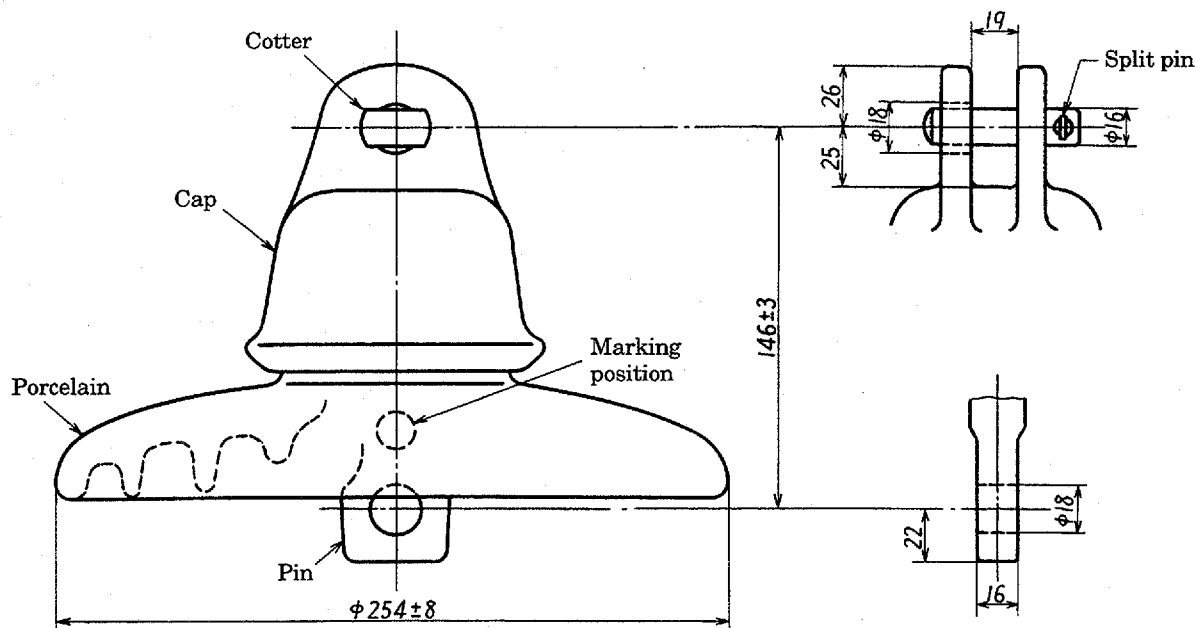
250 mm ball and socket anti-pollution type suspension insulator 165 kN
or SU-165BF

12 Marking The following information shall be marked on porcelain part of an insulator indelibly.

- a) Manufacturer's name or abbreviation
- b) Year of manufacture (In the case of the Christian Era, it may be the last two figures.)
- c) Electro-mechanical failing load

SU-120 CN

Unit: mm



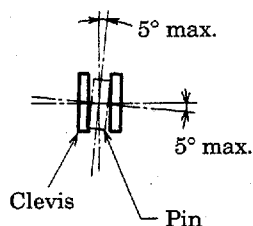
Performances

Wet power-frequency withstand voltage	40 kV
Lightning impulse withstand voltage	105 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	120 kN
Creepage distance	280 mm min.
Power-frequency voltage	75 kV min.
Tensile withstand load	48 kN

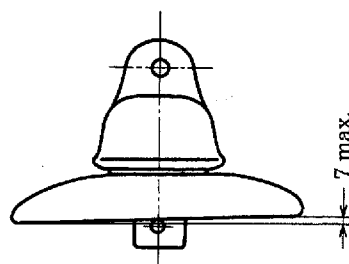
- Remarks 1 Details of dimensions of coupling part of insulator, cotter and split pin shall be as shown in Attached Fig. 11.
- 2 The allowable angular difference between cap and pin shall be not more than 5°, as shown in Attached Fig. 1.1.
- 3 Tolerance on inclination of shed of insulator shall be not more than 7 mm, as shown in Attached Fig. 1.2.

Attached Fig. 1 250 mm clevis type suspension insulator 120 kN

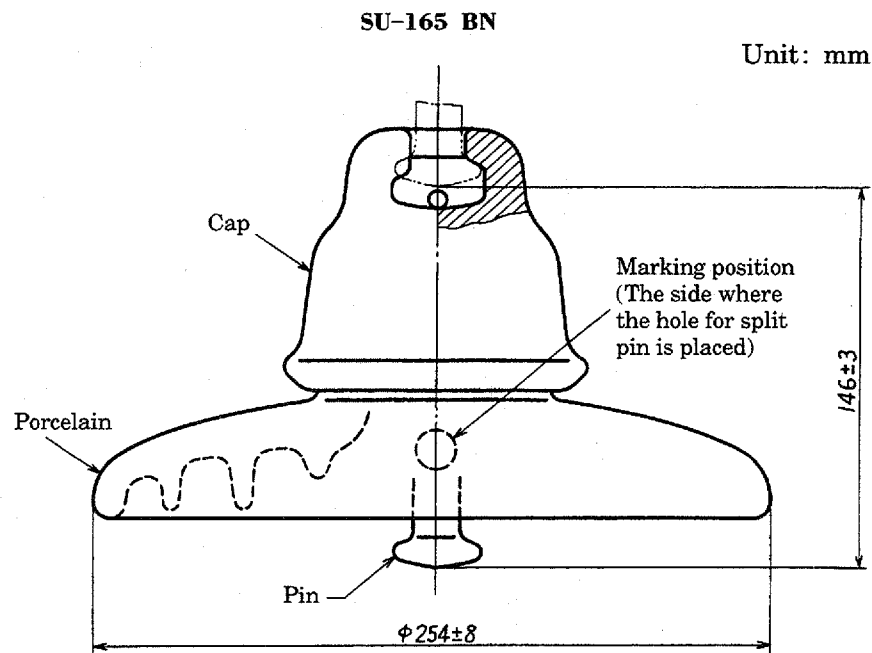
Unit: mm



Attached Fig. 1.1



Attached Fig. 1.2

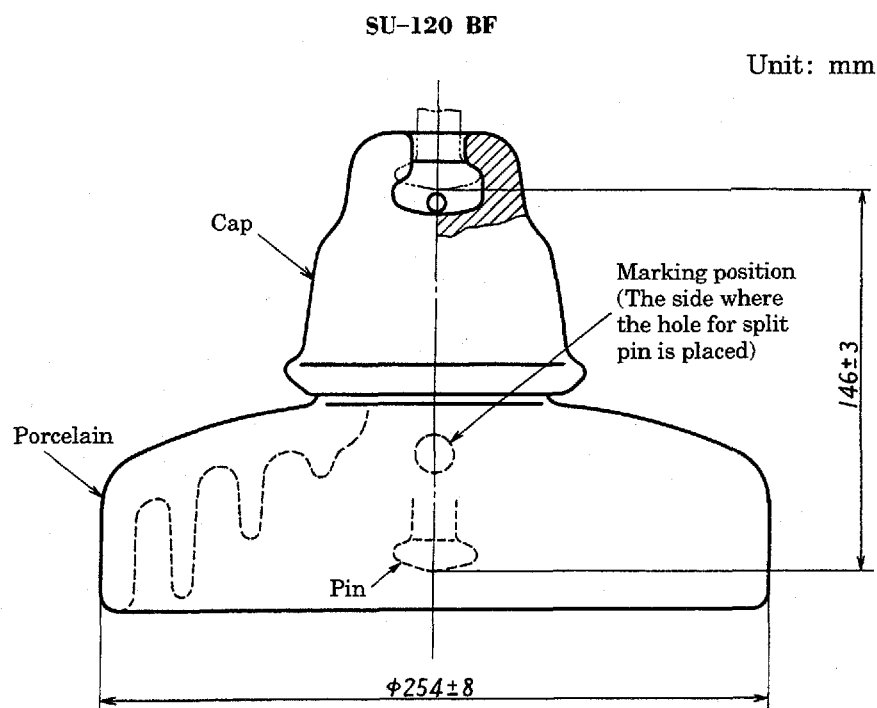


Performances

Wet power-frequency withstand voltage	40 kV
Lightning impulse withstand voltage	105 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	165 kN
Creepage distance	280 mm min.
Power-frequency voltage	75 kV min.
Tensile withstand load	66 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.1 to 13.5.

Attached Fig. 2 250 mm ball and socket type suspension insulator 165 kN

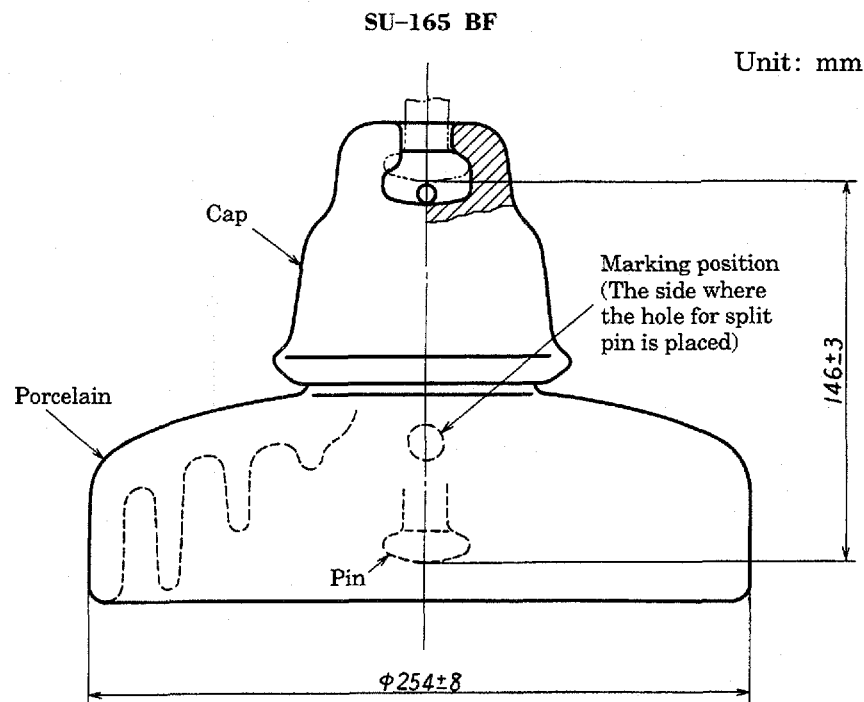


Performances

Wet power-frequency withstand voltage	41 kV
Lightning impulse withstand voltage	120 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	120 kN
Creepage distance	430 mm min.
Power-frequency voltage	75 kV min.
Tensile withstand load	48 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.1 to 13.5.

Attached Fig. 3 250 mm ball and socket anti-pollution type suspension insulator 120 kN

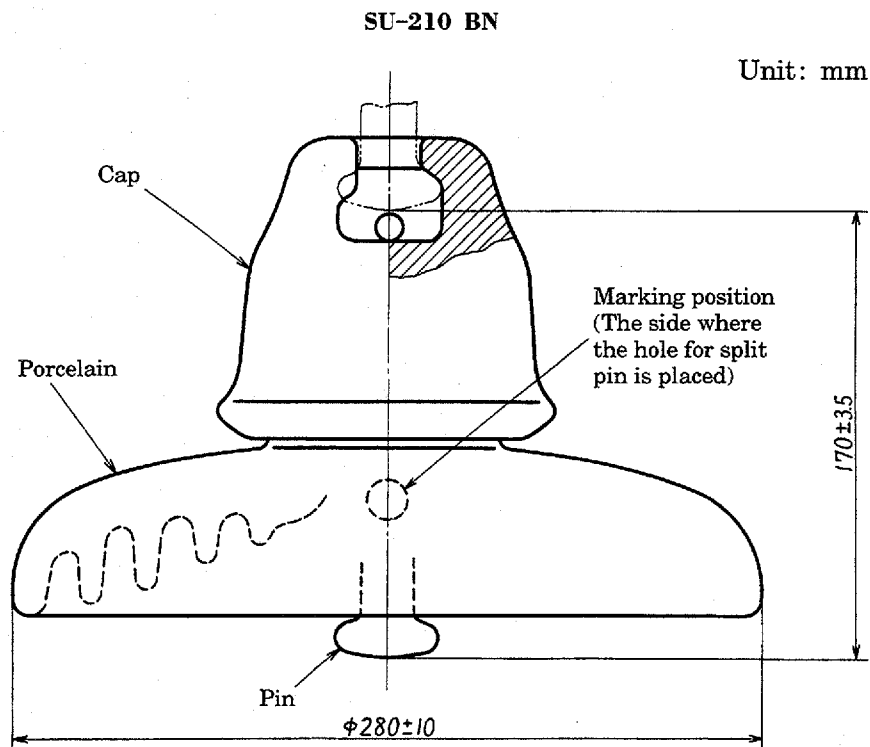


Performances

Wet power-frequency withstand voltage	41 kV
Lightning impulse withstand voltage	120 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	165 kN
Creepage distance	430 mm min.
Power-frequency voltage	75 kV min.
Tensile withstand load	66 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.1 to 13.5.

Attached Fig. 4 250 mm ball and socket anti-pollution type suspension insulator 165 kN

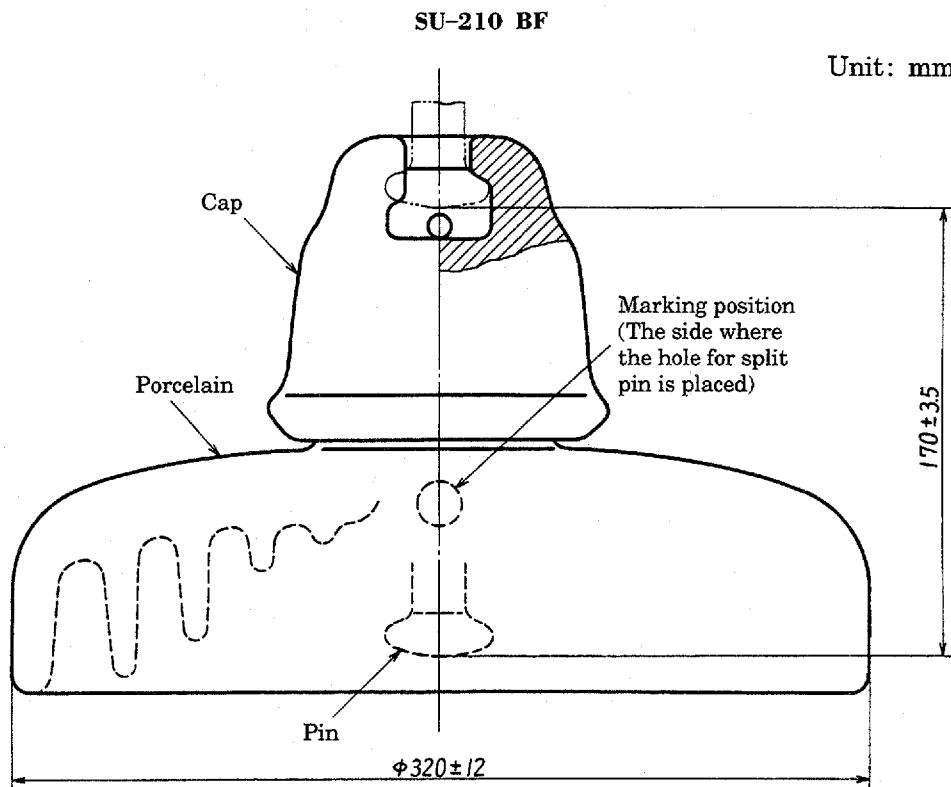


Performances

Wet power-frequency withstand voltage	41 kV
Lightning impulse withstand voltage	115 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	210 kN
Creepage distance	370 mm min.
Power-frequency voltage	80 kV min.
Tensile withstand load	84 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.6 to 13.15.

Attached Fig. 5 280 mm ball and socket type suspension insulator 210 kN



Performances

Wet power-frequency withstand voltage	45 kV
Lightning impulse withstand voltage	135 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	210 kN
Creepage distance	550 mm min.
Power-frequency voltage	85 kV min.
Tensile withstand load	84 kN

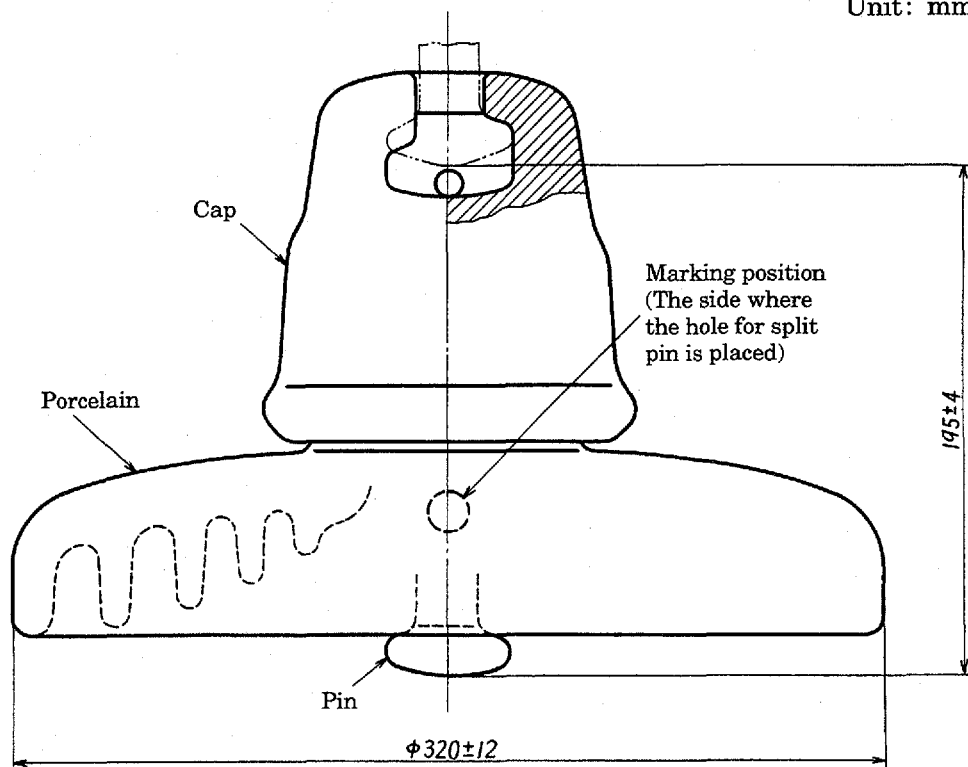
Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.

2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.6 to 13.15.

Attached Fig. 6 320 mm ball and socket anti-pollution type suspension insulator 210 kN

SU-330 BN

Unit: mm

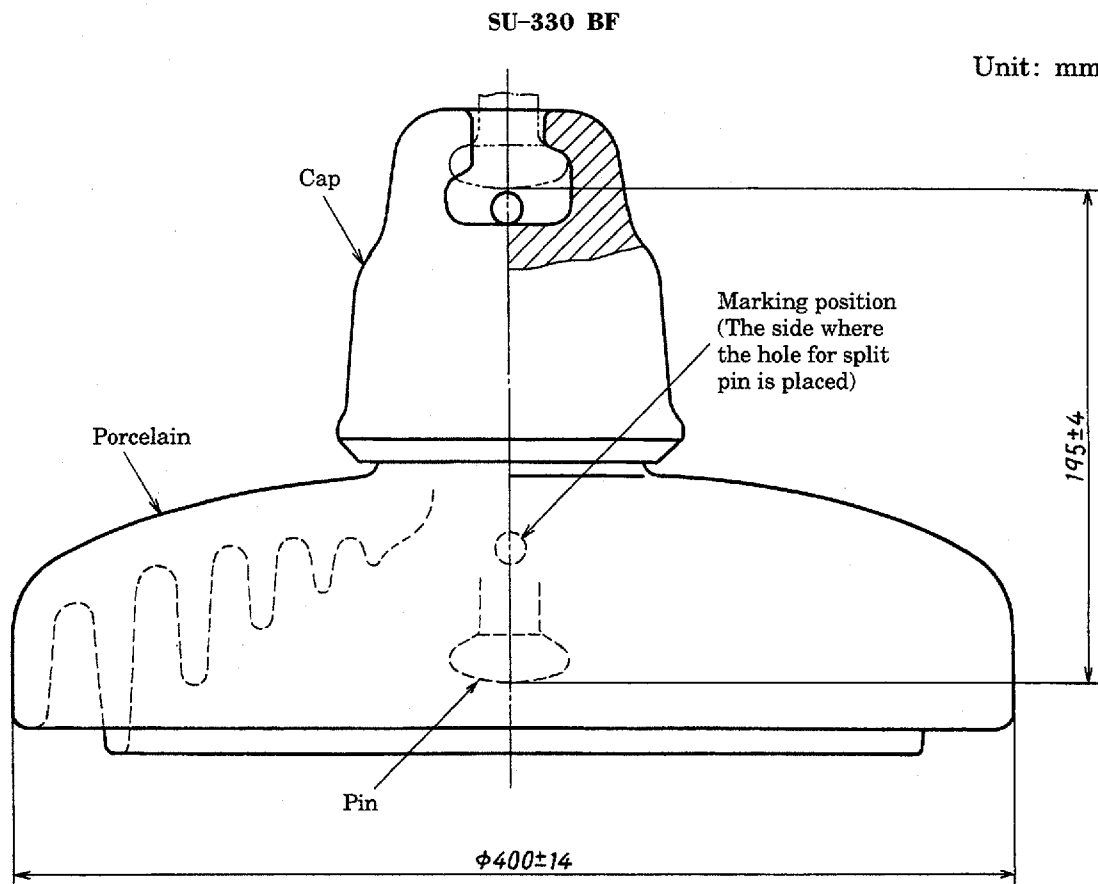


Performances

Wet power-frequency withstand voltage	43 kV
Lightning impulse withstand voltage	120 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	330 kN
Creepage distance	460 mm min.
Power-frequency voltage	85 kV min.
Tensile withstand load	132 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.6 to 13.15.

Attached Fig. 7 320 mm ball and socket type suspension insulator 330 kN

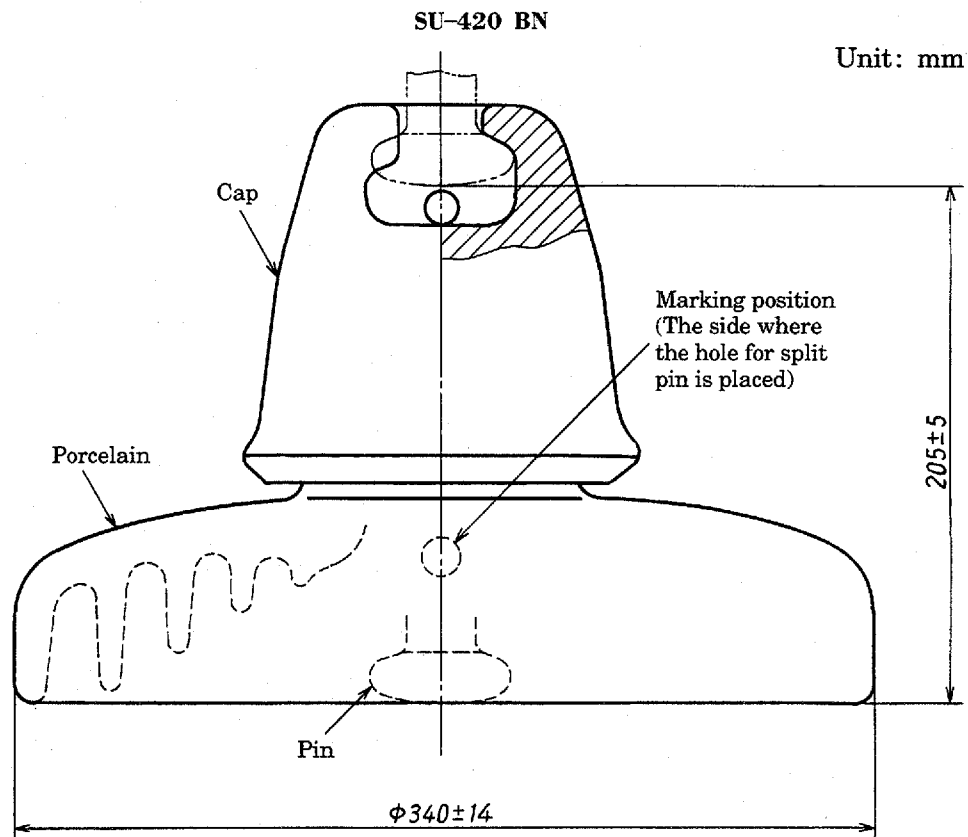


Performances

Wet power-frequency withstand voltage	52 kV
Lightning impulse withstand voltage	155 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	330 kN
Creepage distance	690 mm min.
Power-frequency voltage	95 kV min.
Tensile withstand load	132 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.6 to 13.15.

Attached Fig. 8 400 mm ball and socket anti-pollution type suspension insulator 330 kN

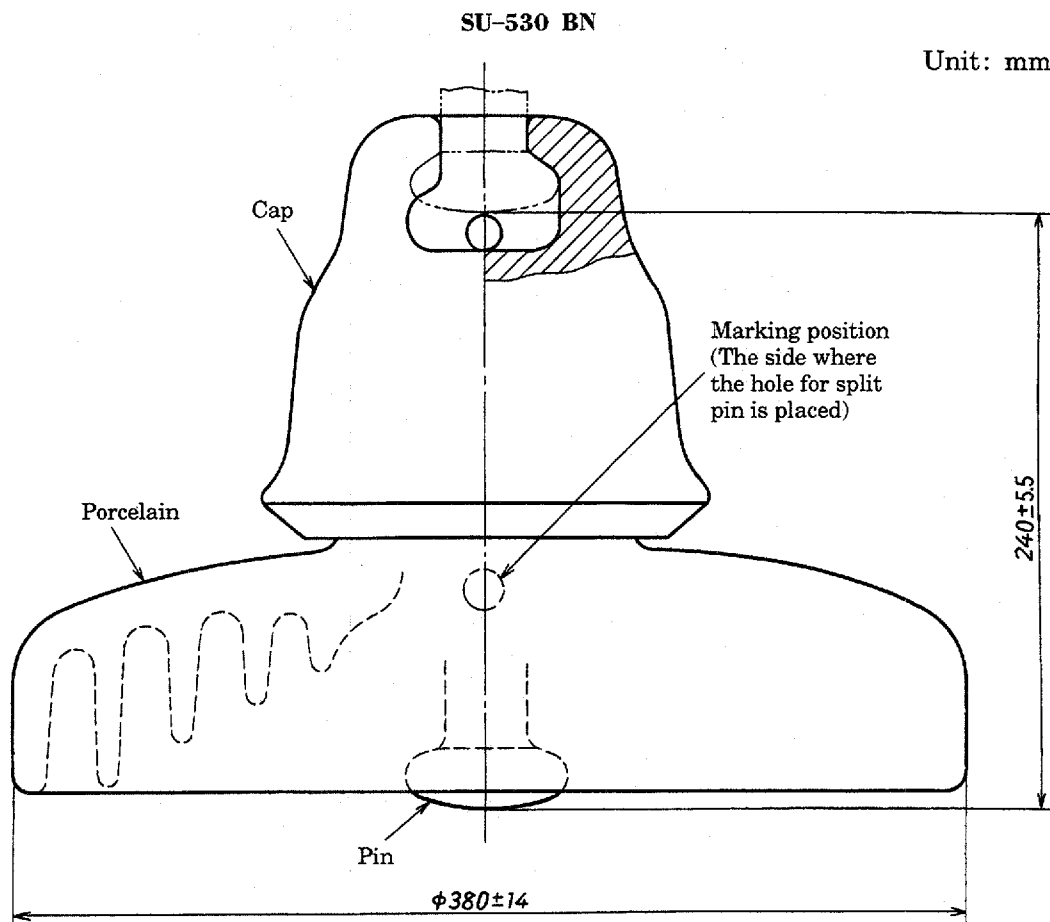


Performances

Wet power-frequency withstand voltage	43 kV
Lightning impulse withstand voltage	125 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	420 kN
Creepage distance	525 mm min.
Power-frequency voltage	95 kV min.
Tensile withstand load	168 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.6 to 13.15.

Attached Fig. 9 340 mm ball and socket type suspension insulator 420 kN



Performances

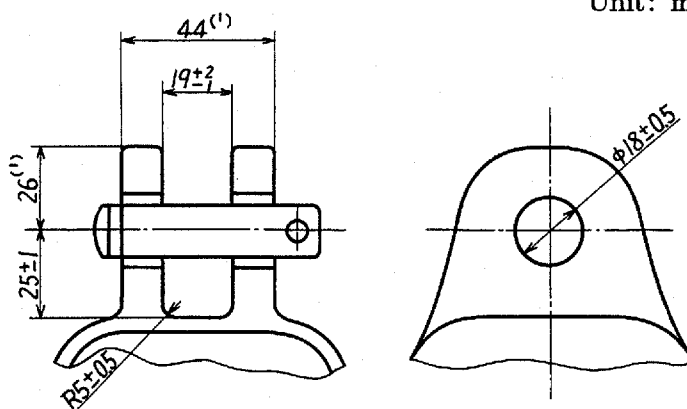
Wet power-frequency withstand voltage	45 kV
Lightning impulse withstand voltage	125 kV
Power-frequency puncture voltage in oil	140 kV
Electro-mechanical failing load	530 kN
Creepage distance	670 mm min.
Power-frequency voltage	95 kV min.
Tensile withstand load	212 kN

- Remarks 1 Details of dimensions of coupling part of insulator and split pin shall be as shown in Attached Fig. 12.
- 2 Ball part and socket part of insulator shall fit the relevant gauges shown in Attached Figs. 13.6 to 13.15.

Attached Fig. 10 380 mm ball and socket type suspension insulator 530 kN

Cap clevis part

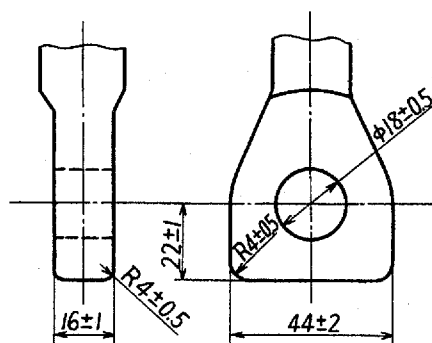
Unit: mm



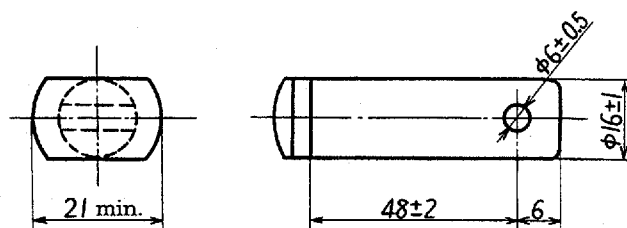
Note (1) Tolerance shall be 0 for + side, and - side is not specified specially.

Remarks : Dimensions without tolerance are basic dimensions.

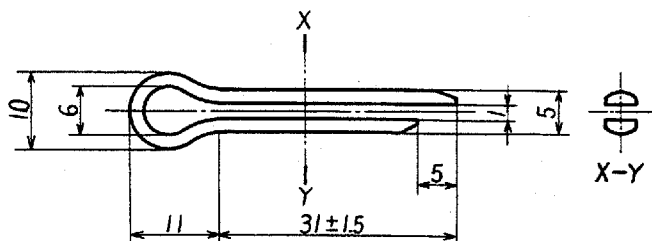
Pin eye part



Cotter



Split pin



Attached Fig. 11 Dimensions of coupling part, cotter and split pin of clevis type suspension insulator